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EXAMINER				
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

**Application No.**

10/568,077

**Applicant(s)**

SMALL ET AL.

**Examiner**

STEPHANIE DUCLAIR

**Art Unit**

4171

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 13 February 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/C)
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date: \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_
- Paper No(s)/Mail Date: \_\_\_\_\_

**DETAILED ACTION**

1. This is the first office action on the merits.
2. Claims 1-20 are pending before the Office for review, of which 1-20 are amended, and no new matter has been added.

***Priority***

3. Applicant's claim for the benefit of a prior-filed application under 35 U.S.C. 119(e) or under 35 U.S.C. 120, 121, or 365(c) is acknowledged.

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
  2. Ascertaining the differences between the prior art and the claims at issue.
  3. Resolving the level of ordinary skill in the pertinent art.
  4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein

were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 1, 7-8, 18 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) in view of MOEGGENBORG et al (U.S. Patent Publication No. 2003/0060135) and FANG (U.S. Patent No. 6,461,227).

8. **With regards to claim 1**, DIRKSEN discloses a method of polishing a substrate surface comprising providing a substrate with at least one feature thereon comprising ruthenium and at least one dielectric material (Page 1 Paragraph [0008]), a metal oxide composition (Page 1 Paragraph [0007]) with metal oxide abrasives in which the abrasive is a silica abrasive (Page 1 Paragraph [0009]), a periodic acid (Page 2 Paragraph [0020]) and contacting the surface with a polishing pad in which the composition is disposed between the polishing pad and the substrate surface (Page 1 Paragraph [0003]).

9. However, DIRKSEN, does not disclose 0.005 – 1 moles/kg of period acid, 0.2 wt% - 6 wt% silica abrasives, an average particle size of 50nm or less and a removal rate of ruthenium of 300 Å/min or more.

10. MOEGGENBORG discloses a chemical mechanical polishing system (Page 1 Paragraph [0010]) using a composition with silica abrasives (Page 1 Paragraph [0011])

with a concentration between 0.1 wt% - 10 wt% (Page 2 Paragraph [0012]), suitable oxidizers including periodic acid (Page 2 Paragraph [0016]) in amounts between 0.001 wt%- 5 wt% (Page 2 Paragraph [0017]) and a removal rates of ruthenium at varying rates such as 98.54 nm/min (Page 3 Paragraph [0027]) and 224.6 nm/min (Page 3 Paragraph [0031]).

11. The secondary reference teaches amounts for the periodic acid and it is the examiner's position that when the said amounts are calculated in terms of moles/kg, said amounts will encompass the claimed amounts. If applicant wishes to argue the claimed amounts, burden is upon applicant to show the contrary to the above statement (i.e. show that the reference range is not within range of the claimed amount).

12. FANG discloses a method of polishing a rigid disk (substrate) using abrasives with a particle size where substantially all of the particles are 7nm, 10nm, 15nm, 25nm and 30 nm. (Col. 2 lines 66-67, Col. 3 lines 1-5).

13. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to modify the method of DIRKSEN to include the composition and removal rates of MOEGGENBORG because the method provides an improved polishing system for polishing noble metal containing substrate since such metals are known to be chemically stable and mechanically hard materials (MOEGGENBORG Page 1 Paragraphs [0006], [007]).

14. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to further modify the method of DIRKSEN to include the abrasive

size of FANG because it provides a method planarizing or polishing with a high removal rate while minimizing defectivity (Col. 1 lines 40-45).

15. **With regard to claim 7**, MOEGGENBORG teaches 1-10 wt% silica abrasives (Page 2 Paragraph [0012]) and 0.2wt% -2 wt% periodic acid. Although MOEGGENBORG does not teach applicant's exact range, "[I]n the case where the claimed ranges 'overlap or lie inside ranges disclosed by the prior art' a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976)." MPEP 2144.05

16. **With regards to claim 8**, DIRKSEN discloses a method for polishing a substrate comprising metal oxide abrasives in which the abrasive is a silica abrasive (Page 1 Paragraph [0009]).

17. However, DIRKSEN does not disclose the particle size.

18. FANG discloses a method of polishing a rigid disk (substrate) using abrasives with a particle size where substantially all of the particles are 7nm, 10nm, 15nm, 25nm and 30 nm. (Col. 2 lines 66-67 Col. 3 lines 1-5). FANG discloses using such particle size in order to obtain a fine polishing system. FANG also discloses using a wide range of particles depending on whether you want a "fine" polishing system or "course" polishing system. MPEP 2144.05(II)(A) states that "Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the

prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

19. **With regards to claim 18**, DIRKSEN discloses a method of polishing a substrate surface comprising providing a substrate with at least one feature thereon comprising ruthenium and at least one dielectric material (Page 1 Paragraph [0008]).

20. However, Dirksen does not disclose the polishing rate of ruthenium.

21. MOEGGENBORG discloses a chemical mechanical polishing system with removal rates of ruthenium at varying rates such as 98.54 nm/min (Page 3 Paragraph [0027]) and 224.6 nm/min (Page 3 Paragraph [0031]).

22. MOEGGENBORG discloses a varying range of removal rates and as such "[d]ifferences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). MPEP 2144.05(II)(A)

23. **With regards to claim 20**, DIRKSEN discloses a method of polishing a substrate surface comprising a composition with a periodic acid (Page 2 Paragraph [0020]).

24. However DIRKSEN does not disclose the concentration of periodic acid.

25. MOEGGENBORG discloses a chemical mechanical polishing system (Page 1 Paragraph [0010]) using a composition with 0.2wt% -2 wt% periodic acid. . Although MOEGGENBORG does not teach applicant's exact range, "[I]n the case where the

claimed ranges 'overlap or lie inside ranges disclosed by the prior art' a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976)." MPEP 2144.05

26. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) as modified by MOEGGENBORG et al (U.S. Patent Publication No. 2003/0060135) and FANG (U.S. Patent No. 6,461,227), as applied to claims 1, 7-8, 10 and 20 above, in further view of EMESH et al. (U.S. Patent No. 5,358,889) .

27. **With regards to claim 19**, modified DIRKSEN discloses the limitations of claim 1 as previously discussed.

28. However modified DIRKSEN does not disclose a composition that is free of sources of chloride ions.

29. MOEGGONBORG discloses that chloride ions can be used but is not required (Page 2 Paragraph [0013]). It further discloses a composition free of chloride ions (Page 3 [0026]).

30. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to modify the method of modified DIRKSEN to include the chloride free composition of MOEGGGONBORG because chloride ions may have a deleterious effect on Si based integrated circuits, a chloride free process is desirable (EMESH et al. Col. 2 Lines 35-37)



31. Claims 2 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) in view of SINHA et al. (U.S. Patent Publication No. 2003/0119319).
32. **With regards to claim 2**, DIRKSEN discloses a method of polishing a substrate surface comprising providing a substrate with at least one feature thereon comprising ruthenium and at least one dielectric material (Page 1 Paragraph [0008]), an aqueous composition with periodic acid and a quaternary amine (Page 2 Paragraph [0020]) wherein the solution has a pH of about 5 or less, about 4-5 (pH of about 2.5 to about 5) (Page 2 Paragraph [0018]).
33. However DIRKSEN does not disclose a chemically mechanically polishing the substrate surface to remove a portion of the ruthenium wherein the removal selectivity of the ruthenium to the low K dielectric is greater than about 20:1.
34. SINHA discloses of method of planarization of group VIII metal containing surfaces comprising a selectivity for removal of materials from 2<sup>nd</sup> and 3<sup>rd</sup> row Group VIII (Ruthenium) containing surface relative to materials containing other metals (BPSG or TEOS) (low k dielectric materials) preferably within the range of 20:1 to about 100:1 (Page 4 Paragraph [0033]).
35. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to modify the method of DIRKSEN to include the method of SINHA because it would provide a method for the removing of 2<sup>nd</sup> and 3<sup>rd</sup> row Group VII metal layers without removing significant amounts of underlying layers such as oxide and nitride layers (dielectric layers) (Page 4 Paragraph [0033]).

36. **With regards to claim 16**, DIRKSEN discloses a pH of less than 5, about 4-5 (Page 2 Paragraph [0018]). Although DIRKSEN does not explicitly disclose the range of between about 3 and about 4, " [I]n the case where the claimed ranges 'overlap or lie inside ranges disclosed by the prior art' a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990)." MPEP 2144.05(I). Since the prior art teaches less than 5 and about 4 this provides for an overlap with applicant's range of between about 3 and about 4.

37. Claims 3, 6, and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) in view of MOEGENBORG et al (U.S. Patent Publication No. 2003/0060135), WANG et al (U.S. Patent No. 6,316,365) and INA et al (U.S. Patent No. 6,355,075).

38. **With regards to claim 3**, DIRKSEN discloses a method of polishing a substrate surface comprising providing a substrate with at least one feature thereon comprising ruthenium, a low dielectric film and a high dielectric constant film (tantalum oxide) (Page 1 Paragraph [0008]), providing an aqueous composition comprising a periodic acid (Page 2 Paragraph [0020]), silica abrasives (Page 1 Paragraph [0009]), and contacting the surface with a polishing pad in which the composition is disposed between the polishing pad and the substrate surface (Page 1 Paragraph [0003]) and sources of chloride ions (Page 2 Paragraph [0020]).

39. However, DIRKSEN does not explicitly disclose a layer of tantalum oxide, 0.1-3 wt% of periodic acid, 0.2-6 wt% of silica abrasives with an average particle size of 50nm or less, 0.5% or less of sources of chloride and a polishing rate of tantalum oxide between 0.8 -1.7 times ruthenium (removal rate ratio of ruthenium : tantalum oxide is 0.58-1.25 calculated based on polishing rate of 300 Å/min, disclosed on page 25 of Specification).

40. MOEGGENBORG discloses a chemical mechanical polishing system (Page 1 Paragraph [0010]) using a composition with silica abrasives (Page 1 Paragraph [0011]) with a concentration between 0.1 wt% - 10 wt% (Page 2 Paragraph [0012]), suitable oxidizers including periodic acid (Page 2 Paragraph [0016]) in amounts between 0.001 wt%- 5 wt% (Page 2 Paragraph [0017]) and a substrate with a metal layer in which that layer is ruthenium (Page 3 Paragraph [0023]).

41. WANG discloses a method of chemical mechanical polishing comprising a substrate with a tantalum removal ratio of the tantalum containing component in relation to the metal layer can be greater than 1 and the removal rate ratio can be less than 1 (Col. 4 lines 60-67). It further discloses that the metal can be ruthenium (Col. 4 lines 32-36). Although WANG does not explicitly disclose applicant's polishing rate, the removal rate ratio of WANG overlaps that of applicant. "In the case where the claimed ranges 'overlap or lie inside ranges disclosed by the prior art' a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed.Cir. 1990)." MPEP 2144.05(I)

42. INA discloses a polishing composition for chemical mechanical polishing in which the substrate contains a tantalum containing compound layer that is tantalum oxide (Col. 5 lines 42-43) with a silicon dioxide abrasive which has a primary particle size of at most 20nm (Col. 5 lines 15-17, 44-45) in concentrations of 1-10 wt% (Col. 5 lines 48-50).

43. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to modify the method of DIRKSEN to include the composition and removal rates of MOEGGENBORG because the method provides an improved polishing system for polishing noble metal containing substrate since such metals are known to be chemically stable and mechanically hard materials (MOEGGENBORG Page 1 Paragraphs [0006], [007]).

44. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to further modify the method of DIRKSEN to include the method of WANG because it provides for a manner in which the planarization efficiency, uniformity, and removal rate are maximized and undesirable effects, such as surface imperfections and damage to underlying topography are minimized (Col. 2 lines 54-60).

45. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to further modify the method of DIRKSEN to include the polishing composition of INA because it allows the metal layer and the barrier layer to be polished at a similar and high stock removal rate (Col. 3 lines 24-27).

46. **With respect to claim 6**, DIRKSEN the use of chloride ions (Page 2 Paragraph [0020]).

47. However DIRKSEN does not disclose the concentration of the chloride ions.
48. MOGGENBORG discloses chloride ions (Page 2 Paragraph [0013]) in a concentration not to exceed about 0.02M (page 2 Paragraph [0015]).
49. The secondary reference teaches amounts for the chloride ions and it is the examiner's position that when the said amounts are calculated in terms of weight percentage said amounts will encompass the claimed amounts. If applicant wishes to argue the claimed amounts, burden is upon applicant to show the contrary to the above statement (i.e. show that the reference range is not within range of the claimed amount).
50. **With respect to claim 10**, DIRKSEN discloses the use of an amine (Page 2 Paragraph [0020]) in which the composition will have a pH of 7 or less (Page 1 Paragraph [0017]).
51. Claims 4 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) in view of MOEGGENBORG et al (U.S. Patent Publication No. 2003/0060135) and INA et al (U.S. Patent No. 6,355,075).
52. **With respect to claims 4 and 17** DIRKSEN discloses a method of polishing a substrate surface comprising providing a substrate with at least one feature thereon comprising ruthenium (noble metal) and an aqueous solution of periodic acid and a quaternary amine (Page 2 Paragraph [0020]) where in the solution has a pH of 5 or less, about 4-5 (Page 2 [0018]), a metal oxide abrasive in which the abrasive is a silica abrasive (Page 1 Paragraph [0009]), and contacting the surface with a polishing pad in

which the composition is disposed between the polishing pad and the substrate surface (Page 1 Paragraph [0003]). The amine of DIRKSEN is capable of controlling the pH of the solution.

53. However DIRKSEN does not disclose the concentration of periodic acid, concentration of silica abrasives and the primary particle size of the abrasives.

54. MOEGGENBORG discloses a chemical mechanical polishing system (Page 1 Paragraph [0010]) comprising providing a substrate with a noble metal (Page 1 Paragraph [0006]), using a composition with periodic acid (Page 2 Paragraph [0016]) in amounts between 0.001 wt%- 5 wt% (Page 2 Paragraph [0017]) and silica abrasives (Page 1 Paragraph [0011]) in a concentration between 0.1 wt% - 10 wt% (Page 2 Paragraph [0012]).

55. INA discloses a polishing composition for chemical mechanical with a silicon dioxide abrasive which has a primary particle size of at most 20nm (Col. 5 lines 15-17, 44-45).

56. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to modify the method of DIRKSEN to include the composition and removal rates of MOEGGENBORG because the method provides an improved polishing system for polishing noble metal containing substrate since such metals are known to be chemically stable and mechanically hard materials (MOEGGENBORG Page 1 Paragraphs [0006], [007]).

57. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to further modify the method of DIRKSEN to include the polishing

composition of INA because it allows the metal layer and the barrier layer to be polished at a similar and high stock removal rate (Col. 3 lines 24-27).

58. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) as modified by MOEGGENBORG et al (U.S. Patent Publication No. 2003/0060135) and FANG (U.S. Patent No. 6,461,227), as applied to claims 1, 7-8, 10 and 20, in further view of SINHA et al. (U.S. Patent Publication No. 2003/0119319).

59. **With regards to claim 5**, modified DIRKSEN discloses all the limitations of claim 1 as previously discussed.

60. However modified DIRKSEN does not disclose a substrate with a PETOS dielectric, TEOS dielectric or BSPG dielectric where in the removal selectivity of ruthenium to the dielectric is greater than about 20:1.

61. SINHA discloses of method of planarization of group VIII metal containing surfaces comprising a selectivity for removal of materials from 2<sup>nd</sup> and 3<sup>rd</sup> row Group VIII (Ruthenium) containing surface relative to materials containing other metals (BPSG or TEOS) preferably within the range of 20:1 to about 100:1 (Page 4 Paragraph [0033]).

62. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to modify the method of modified DIRKSEN to include the method of SINHA because it would provide for the removing of 2nd and 3rd row Group VII metal layers without removing significant amounts of underlying layers such as oxide and nitride layers (dielectric layers) (Page 4 Paragraph [0033]).

63. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) as modified by of SINHA et al. (U.S. Patent Publication No. 2003/0119319), as applied to claims 2 and 16 above, in further view of MOEGGENBORG et al (U.S. Patent Publication No. 2003/0060135).

64. **With regards to claim 9**, modified DIRKSEN discloses all the limitations of claim 2 including a method of polishing a substrate surface comprising silica abrasives (Page 1 Paragraph [0009]), and a periodic acid (Page 2 Paragraph [0020]).

65. However, modified DIRKSEN, does not disclose 0.005 – 1 moles/kg of period acid, 0.2 wt% - 6 wt% silica abrasives, an average particle size of 50nm or less and a removal rate of ruthenium of 300 Å/min or more.

66. MOEGGENBORG discloses a chemical mechanical polishing system (Page 1 Paragraph [0010]) using a composition with silica abrasives (Page 1 Paragraph [0011]) with a concentration between 0.1 wt% - 10 wt% (Page 2 Paragraph [0012]) and suitable oxidizers including periodic acid (Page 2 Paragraph [0016]) in amounts between 0.001 wt%- 5 wt% (Page 2 Paragraph [0017]) .

67. The secondary reference teaches amounts for the periodic acid and it is the examiner's position that when the said amounts are calculated in terms of moles/kg, said amounts will encompass the claimed amounts. If applicant wishes to argue the claimed amounts, burden is upon applicant to show the contrary to the above statement (i.e. show that the reference range is not within range of the claimed amount).



68. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to modify the method of modified DIRKSEN to include the composition and removal rates of MOEGGENBORG because the method provides an improved polishing system for polishing noble metal containing substrate since such metals are known to be chemically stable and mechanically hard materials (MOEGGENBORG Page 1 Paragraphs [0006], [007]).

69. Claims 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) as modified by MOEGGENBORG et al (U.S. Patent Publication No. 2003/0060135) and FANG (U.S. Patent No. 6,461,227), as applied to claims 1, 7-8, 10 and 20 above, in further view of JACQUINOT et al (U.S. Patent No. 6,043,159) and BUEHLER (U.S. Patent No. 6,746,498).

70. **With respect to claim 11**, modified DIRKSEN teaches all the limitations of claim 1 as previously discussed.

71. However modified DIRKSEN does not explicitly disclose wherein at least 50% of the weight of the silica is in a chain like structure with a length to width ratio of at least 4.

72. JACQUINOT discloses a method of chemical mechanical polishing a substrate where an aqueous solution of colloidal particles of pyrogenic silica, fumed silica (silica with a 100% chain like structure) with a length to width ratio of at least 4 (Col. 1 lines 53-56, assume structure length of 500nm, width of 50nm, disclosed ratio of 10).

73. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to modify the method of modified DIRKSEN to include the pyrogenic silica of JAUINOT because fumed silica enables high polishing rates (BUEHLER Col. 1 lines 30-31).

74. Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) as modified by MOEGGENBORG et al (U.S. Patent Publication No. 2003/0060135), FANG (U.S. Patent No. 6,461,227), JACQUINOT et al (U.S. Patent No. 6,043,159) and BUEHLER (U.S. Patent No. 6,746,498), as applied to claim 11, and in further view of BASIM et al (Effect of Particle Size of Chemical Mechanical Polishing Slurries for Enhanced Polishing with Minimal Defects).

75. **With respect to claim 12**, modified DIRKSEN discloses all the limitations of claim 1 as previously discussed.

76. However modified DIRKSEN does not explicitly disclose where in at least 50% of the weight of the silica is in aggregates with an aggregate diameter of about 0.03 to 0.05 microns before polishing.

77. JACQUINOT discloses a method of chemical mechanical polishing a substrate where an aqueous solution of colloidal particles of pyrogenic silica as an aggregate, fumed silica (silica with a 100% chain like structure as an aggregate) with an aggregate particle diameter of 5-50 nm (0.005 to 0.05 microns) (Col. 1 lines 53-56).

78. At the time of the invention, it would have been prima facie obvious to one of ordinary skill in the art to modify the method of modified DIRKSEN with the particle diameter of JACQUINOT because it is important to know the optimal abrasive size distribution to enhance the removal rate without damaging the wafer surface (BASIM, Section 1 Introduction Col. 1 Paragraph 1).

79. **With respect to claim 13**, modified DIRKSEN teaches all the limitations of claim 1 as previously discussed.

80. However modified DIRKSEN does not explicitly disclose wherein at least 70% of the weight of the silica is in a chain like structure with a length to width ratio of at least 4 and an aggregate diameter of about .03 to 0.05 microns before polishing.

81. JACQUINOT discloses a method of chemical mechanical polishing a substrate where an aqueous solution of colloidal particles of pyrogenic silica, fumed silica (silica with a 100% chain like structure) in aggregate form (100% of silica in aggregate form) with a length to width ratio of at least 4 (Col. 1 lines 53-56, assume structure length of 500nm, width of 50nm, disclosed ratio of 10) and aggregate particle diameter of 5-50 nm (0.005 to 0.05 microns) 4 (Col. 1 lines 53-56).

82. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) as modified by MOEGGENBORG et al (U.S. Patent Publication No. 2003/0060135) and FANG (U.S. Patent No. 6,461,227), as applied to claims 1, 7-8, 10 and 20 above, in further view of ATHAVALÉ et al (U.S. Patent No. 6,261,967).

83. **With regards to claim 14**, modified DIRKSEN discloses all the limitations of claim 1 as previously discussed.

84. However modified DIRKSEN does not explicitly disclose where the substrate further comprises a hard mask material wherein the polishing rate of the hard mask material is equal to or greater than the polishing rate of the ruthenium.

85. ATHAVALLE discloses a substrate with a hard mask and a noble metal in which the hard mask may be used for the selective etching of the noble metal. It further discloses that the hard mask is etched selective to the noble metal and can be removed using a wet etching method (CMP) (Col 7 lines 5-11). Although ATHAVALLE does not state that the polishing rate of the hard mask is greater than the polishing rate of the ruthenium, this aspect is inherent since the hard mask can be patterned and remain on the noble metal while the noble metal layer is patterned to its shape.

86. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to modify the method of modified DIRKSEN to include the hard mask of ATHAVALLE because the hard mask allows the etching of the noble metal and is easily removed after the patterning process (Col. 1 lines 50-53)

87. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over DIRKSEN et al (U.S. Patent Publication No. 2002/0076932) as modified by of SINHA et al. (U.S. Patent Publication No. 2003/0119319), as applied to claims 2 and 16 above, in further view of INA et al (U.S. Patent No. 6,355,075) and WANG et al (U.S. Patent No. 6,316,365).

88. **With regards to claim 15**, modified DIRKSEN discloses all the limitations of claim 2.

89. However modified DIRKSEN does not teach where in the substrate comprises at least one of tantalum oxide or titanium oxide, where in the polishing rate of the tantalum oxide and/or titanium oxide is between 0.9 and 1.3 times the polishing rate or ruthenium (polishing rate ratio of 0.77-1.11, calculated based on polishing rate of 300 Å/min, disclosed on page 25 of Specification).

90. INA discloses a polishing composition for chemical mechanical polishing in which the substrate contains a tantalum containing compound layer that is tantalum oxide (Col. 5 lines 42-43).

91. WANG discloses a method of chemical mechanical polishing comprising a substrate with a tantalum removal ratio of the tantalum containing component in relation to the metal layer can be greater than 1 and the removal rate ratio can be less than 1 (Col. 4 lines 60-67). It further discloses that the metal can be ruthenium (Col. 4 lines 32-36). Although WANG does not explicitly disclose applicant's polishing rate, the removal rate ratio of WANG overlaps that of applicant. "In the case where the claimed ranges 'overlap or lie inside ranges disclosed by the prior art' a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed.Cir. 1990)." MPEP 2144.05(I).

92. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to further modify the method of DIRKSEN to include the tantalum

oxide layer of INA because it acts as a barrier layer, preventing the diffusion of the atoms of the metal layer into the insulating layer (Col. 1 lines 49-50).

93. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to further modify the method of DIRKSEN to include the method of WANG because it provides for a manner in which the planarization efficiency, uniformity, and removal rate are maximized and undesirable effects, such as surface imperfections and damage to underlying topography are minimized (Col. 2 lines 54-60).

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEPHANIE DUCLAIR whose telephone number is (571)270-5502. The examiner can normally be reached on Monday - Friday, 8:00AM - 4:30PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Barbara Gilliam can be reached on 571-272-1330. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/S. D./  
Examiner, Art Unit 4171